

# Avifauna and vegetation of the Shume *Juniperus* forest in the West Usambara mountains, Tanzania

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The West Usambara mountains, Tanzania (04°30' S, 38°20' E) are a large upland block of ancient crystalline gneiss rising to nearly 2300 m and covering about 2200 km<sup>2</sup>. They are 70 km from the Indian Ocean and less than 5 degrees south of the equator, and so have an oceanic climate with a bimodal rainfall peaking in November and April, the wettest areas receiving 2000 mm mean annual rainfall a year. Moist forest occurs from 150–2285 m altitude and covers extensive areas of the wetter eastern, southern, and northern sides of the mountain (Figure 1). Of the total forest area of 24,532 ha, less than 2% is below 1065 m (van der Willigen & Lovett 1979).

The western side of the mountain in the rainshadow is considerably drier than the other sides, and the vegetation changes accordingly, becoming woodland, thicket, and scrub. However, at higher altitudes between 1890 and 2070 m in the west and central area a distinctive low-canopy forest occurs associated with *Juniperus procera* (East African Pencil Cedar). At one time this vegetation type was extensive, covering more than 15,000 ha, but is now reduced to a heavily disturbed remnant of 1293 ha (Figure 2) following replacement of natural forest by pine plantations, and the excision of 12,000 ha of Shume-Magamba forest reserve in 1963 for local cultivation (Lundgren 1978).

This paper is based on work carried out in 1979, 1980 and 1983 in the Shume *Juniperus* forest and at two sites in the adjacent Shume-Magamba forest at 2100 m and 1800 m altitude. A short review of vegetation and climate in each of the sites is given, followed by methods used in the study and a discussion of the results in relation to forest classification and conservation.

## Vegetation and climate

The Shume *Juniperus* forest canopy is irregular at between 10 to 20 m and there is extensive grass cover on the forest floor. *Juniperus procera* is the tallest tree, with large individuals reaching 30 m. Other trees over 20 m include *Warburgia ugandensis* ssp. *ugandensis*, *Calodendrum eickii*, *Rawsonia lucida*, *Trichocladus ellipticus* and *Diospyros natalensis*. Although *Juniperus procera* is the most easily recognised tree, the commonest tree is *Catha edulis*. The forest



**Figure 1.** Map of the West Usambara mountains, with forest in black (from Lovett & Van der Willigen 1979).

is classified as 'Cedar' (*Juniperus*) forest by Moreau (1935) and Pitt-Schenkel (1938). A check-list of plants occurring in the Usambara mountains and a review of forest conservation have been published by Iversen (1991a, 1991b). The soils and plantations at Shume are described by Lundgren (1978), and an account of biological values of the Usambara forests is given by Rodgers & Homewood (1982).

The Shume-Magamba sites are rather different to the *Juniperus* forest. The 2100 m site (38°15' E, 4°42' S) is on top of a ridge, with a combination of closed canopy forest and open areas with *Erica*. The forest is composed mostly of small diameter poles and has a low canopy 12–15 m high with *Polyscias stuhlmannii*, *Aphloia theiformis*, *Trichocladus ellipticus* and *Macaranga kilimandscharica*. The shrub layer is composed mostly of Rubiaceae, and the herb layer of ferns. The 1800 m site (38°15' E, 4°44' S) is on a valley side below Grewall's saw mill in Shume Nature Reserve and has a canopy 30–40 m high with emergents to 60 m, a well developed, diverse mid-storey, a shrub layer dominated by Rubiaceae and a herb layer dominated by *Isoglossa lactea*. Canopy trees include *Chrysophyllum gorungosanum*, *Podocarpus falcatus* and *Ocotea usambarensis*.

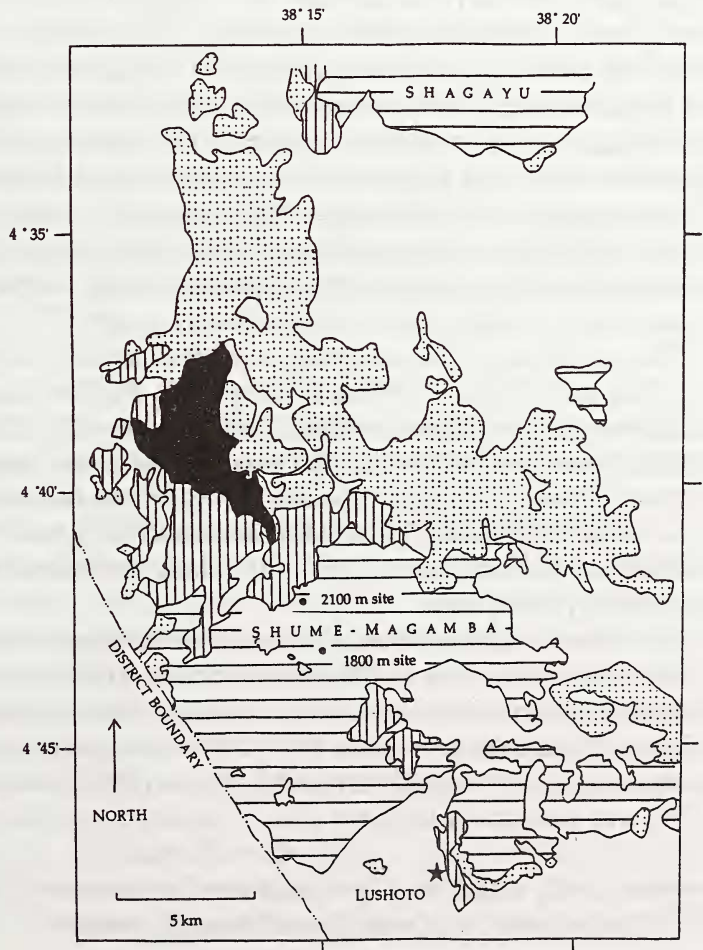
Annual rainfall means for six different rainfall stations around the *Juniperus* forest are given in Table 1. Total rainfall varied considerably from

year to year, with years of high and low rainfall being similar in most of the stations. Monthly rainfall shows the bi-modal rainfall pattern characteristic of the Usambara mountains, with peaks in November–December and March–April. There is a marked dry season from June to September. Light frosts occur occasionally during the cold season in June and July (Moreau 1935, Pitt-Schenkel 1938, Lundgren 1978). The Mlomboza station gives the rainfall for the 2100 m site, and the rainfall at the 1800 m site can be estimated from a rainfall station at Grewall's sawmill which has an annual rainfall of around 1100 mm (Lundgren 1978).

## Methods

Woody vegetation was assessed using two methods. In both the *Juniperus* forest and Shume-Magamba 1800 m site, five variable area plots were enumerated in which the nearest twenty trees to an objectively chosen point of greater than or equal to 20 cm diameter at breast height (dbh) were measured, and identified (Hall 1991). Half way between the 20th tree and

**Figure 2.** Map of the West Usambara *Juniperus* forest and surrounding area. the *Juniperus* forest is marked in black. Natural moist forest existing in 1976 is marked by horizontal lines. Areas deforested between 1954 and 1976 are stippled. Derived from Tanga Integrated Rural Development Programme (TIRDEP) airphoto interpretation project.





**Table 1.** Number of years of records, mean annual rainfall, and standard deviation of rainfall data from six rainfall stations around the Shume *Juniperus* forest

Rainfall station	No. of years of observations	Mean annual rainfall $\pm$ s.d. (mm)
Shume Forest Station	21	723 $\pm$ 134
Gologolo Nursery	18	974 $\pm$ 226
Gologolo Forest House	15	816 $\pm$ 155
Mlomboza	12	892 $\pm$ 234
Manolo	9	546 $\pm$ 96
Lukosi Forest Station	4	638 $\pm$ 184

the 21st tree was taken as the plot radius, enabling density and basal area estimates to be made. This method has been used extensively in the West Usambaras (Lovett 1992) and so direct comparisons between the *Juniperus* forest and other areas were possible. This was done using a reciprocal averaging method of ordination (Hill 1973). The second method was to enumerate subjectively positioned fixed area plots. Several different plot sizes and girth limits were used. Plot 1 in the *Juniperus* forest and the 1800 m site plot were 500 m<sup>2</sup> and all individuals greater than 2 m tall were recorded. Plot 2 in the *Juniperus* forest was 625 m<sup>2</sup> and all individuals greater than or equal to 3 cm dbh were recorded. The 2100 m site plot was 256 m<sup>2</sup> and all individuals greater than or equal to 10 cm dbh were recorded. Plants were named in the field and voucher material collected for confirmation of their identification at the herbarium, Royal Botanic Gardens, Kew. Nomenclature follows the Flora of Tropical East Africa and subsequent taxonomic revisions. *Podocarpus* species could not be separated when sterile; *P. falcatus* fruits were seen, and it is likely that *P. latifolius* also occurs.

The avifauna of the *Juniperus* forest was studied during a visit to the area by SNS and Edwin O. Willis in May 1981. Further data were gathered from searches for specimens collected in this area by R.E. Moreau during the 1930s, now housed in the National Museum of Kenya, Nairobi, and the British Museum (Natural History) Tring. Some further information was also provided by Moreau (1935). Moreau found only two species in these forests which we did not locate, and so the data presented here can be considered reasonably complete.

In order to compare the avifauna of the *Juniperus* forest with those of SNS's other study sites (one at 1800 m and one at 2100 m) further to the east in the Shume-Magamba Forest Reserve, a quantitative approach was adopted. The Shume-Magamba sites were both richer in species, with 55 and 46 species respectively. Following Diamond & Fayad (1979), Sørensen's Similarity Index (Qs) was calculated for each pair of localities, as follows:

$$Q_s = 2j / (a + b)$$

where *j* is the number of species shared between two forests, and *a* and *b* are the total number of species found in each forest.

## Results

### Vegetation

The total area of the five variable area plots in the *Juniperus* forest was 0.54 ha, and the total basal area of the trees enumerated was estimated to be 8.3 m<sup>2</sup> (calculated from the diameter at breast height, assuming each tree to be circular in cross section), giving a basal area of 15.4 m<sup>2</sup>/ha. Of the 100 trees enumerated 55% were *Catha edulis*, contributing 45.4% of the basal area. *Juniperus procera* contributed 14% of the individuals and 25.5% of the basal area. *Euphorbia* sp. only occurred in one plot, but contributed 10% of the individuals and 10.9% of the basal area, indicating that this species occurs in clumps (Table 2). The remaining eight species contributed 21% of the individuals and 18.2 % of the basal area. The five Shume Magamba variable area plots covered an area of 0.41 ha, with a basal area of 30 m<sup>2</sup>, or 73.2 m<sup>2</sup>/ha. *Ocotea usambarensis* contributed 22% of the individuals and 55.1% of the basal area, and was co-dominant with *Podocarpus* which contributed 19% of the individuals and 15.4% of the basal area (Table 3). Only *Catha edulis* occurred in both the *Juniperus* forest and 1800 m site plots.

The Shume *Juniperus* forest fixed-area plots again demonstrated the dominance of *Catha edulis*. Plot 1 gave a total estimated basal area contribution of 1.6 m<sup>2</sup>/ha and plot 2, 2.9 m<sup>2</sup>/ha (Table 4). Because different plot sizes and girth limits were used, the three fixed-area plots could not be compared directly. One species, *Trichocladus ellipticus*, occurred in all three plots. *Cassipourea malosana* also occurs in all three sites as it was recorded in the 2100 m plot, and in the 1800 m variable area plots. In comparison to 88 other variable area plots from the West Usambara mountains (only one of which contained *Juniperus*), the five *Juniperus* forest plots ordinated entirely separately as a distinct cluster.

### Birds

Analysis of the avifauna showed that the *Juniperus* forest bird communities are distinct from those in other forest formations a few kilometres to the east. Only 35 bird species are known from the *Juniperus* forests (Table 5). Two of these, the Common Drongo *Dicrurus adsimilis* and Retz's Helmet-shrike *Prionops retzii*, were recorded by Moreau, but not by us. Of these *D. adsimilis* is not normally considered a forest species in the Usambaras, but apparently behaves as such in the *Juniperus* forest (and also in the Shagayu Forest in the extreme north of the West Usambaras (SNS pers. obs.)). Three other species, the Scaly Francolin *Francolinus squamatus*, the Cape Robin Chat *Cossypha caffra*, and the Cinnamon Bracken Warbler *Bradypterus cinnamomeus*, occur within the forest, but otherwise behave as non-forest species in the Usambaras.

The following species are abundant in the forest: Moustached Green Tinkerbird *Pogoniulus leucomystax*, African Hill Babbler *Pseudoalcippe abyssinica*, Mountain Greenbul *Andropadus nigriceps*, Cape Robin Chat

**Table 2.** Results of *Juniperus* forest variable area plots (100 trees of 11 species enumerated in 5 plots covering 0.54 ha; total basal area 8.3 m<sup>2</sup> and basal area/ha 15.4 m<sup>2</sup>)

Species	No. individuals	No. plots	Basal area cm <sup>2</sup>	% basal area
<i>Catha edulis</i>	55	5	37802	45.4
<i>Juniperus procera</i>	14	4	21241	25.5
<i>Euphorbia</i> sp.	10	1	9048	10.9
<i>Psydrax schimperiana</i>	6	4	5988	7.2
<i>Euclea divinorum</i>	7	3	3259	3.9
<i>Mystroxydon aethiopicum</i>	2	2	2463	3.0
<i>Olea europea</i>	2	2	1749	2.1
<i>Cassipourea malosana</i>	1	1	511	0.6
<i>Canthium mombazense</i>	1	1	398	0.5
<i>Ptaeroxylon obliquum</i>	1	1	434	0.5
<i>Diospyros natalensis</i>	1	1	346	0.4

*Cossypha caffra*, Spot-throat *Modulatrix stictigula*, White-starred Robin *Pogonocichla stellata*, Black-headed Apalis *Apalis melanocephala*, Bar-throated Apalis *A. thoracica*, Evergreen Forest Warbler *Bradypterus lopezi*, Cinnamon Bracken Warbler *B. cinnamomeus*, Red-capped Forest Warbler *Orthotomus metopias*, African Dusky Flycatcher *Muscicapa adusta*, Black-backed Puffback *Dryoscopus cubla*, Fülleborn's Black Boubou *Laniarus fueleborni*, Black-fronted Bush-shrike *Malaconotus multicolor*, Eastern Double-collared Sunbird *Nectarinia mediocris* and Red-faced Crimson-wing *Cryptospiza reichenovii*.

Other species seem to be much rarer, and the scarce Usambara Ground Robin *Sheppardia montana* and Usambara Weaver *Ploceus nicolli*, both known from the moister forest three kilometres to the east, are apparently absent. Non-forest species recorded in the cattle-grazed clearings include Speckled Mousebird *Colius striatus*, Malachite Sunbird *Nectarinia famosa* and Streaky Seed-eater *Serinus striolatus*, while Scarce Swift *Schoutedenapus myoptilus* is common. Moreau (1935) records Namaqua Dove *Oena capensis* and Red-cheeked Cordon-bleu *Uraeginthus bengalus* from this area, non-forest species unknown elsewhere in the Usambaras. There are no recent records of either species. Stuart & Jensen (1981) recorded the Rufous-breasted Sparrowhawk *Accipiter rufiventris* from the *Juniperus* forest, but this was later discovered to be a misidentification of the African Goshawk *Accipiter tachiro*.

The two sites in the Shume-Magamba Forest Reserve had extremely similar avifaunas ( $Q_s = 0.911$ ), whereas the *Juniperus* forest was relatively distinct, being marginally more similar to the study site at 2100 m in Shume-Magamba ( $Q_s = 0.716$ ) than to the site at 1800 m ( $Q_s = 0.667$ ).



## Discussion

The *Juniperus* forest large tree associations are markedly different from the surrounding moister forest types, as demonstrated by ordination analysis. The basal area and species diversity are also low compared to the other West Usambara forests. The *Juniperus* forest plots have a basal area of 15.4 m<sup>2</sup>/ha and an average of 5 species/plot. In contrast, the Shume-Magamba 1800 m plots have a basal area of 73.2 m<sup>2</sup>/ha and an average of 9 species/plot. In other variable area plots in the West Usambara mountains, upper montane forest has an average basal area of 54.5 m<sup>2</sup>/ha, with 9 species/plot; montane forest has an average basal area of 61.9 m<sup>2</sup>/ha with 10 species/plot; and submontane forest has an average basal area of 48.4 m<sup>2</sup>/ha with 10 species/plot (Lovett 1992).

The avifauna of the *Juniperus* forest is also distinct from other forest bird communities in the Usambaras. This difference appears to lie in the absence

**Table 3.** Results of Shume-Magamba variable area plots (100 trees of 22 species enumerated in 5 plots covering 0.41 ha; total basal area 30.0 m<sup>2</sup> and basal area/ha 73.2 m<sup>2</sup>)

Species	Number of individuals	Number of plots	Basal area cm <sup>2</sup>	% basal area
<i>Ocotea usambarensis</i>	22	5	165521	55.1
<i>Podocarpus</i>	19	5	46191	15.4
<i>Nuxia congesta</i>	7	4	27333	9.1
<i>Drypetes gerrardii</i>	7	3	19612	6.5
<i>Dasylepis integra</i>	7	3	5616	2
<i>Trichocladus ellipticus</i>	9	3	5200	1.7
<i>Albizia gummifera</i>	1	1	4536	1.5
<i>Pouteria adolfi-friedericii</i>	1	1	4301	1.4
<i>Chrysophyllum gorungosanum</i>	1	1	4072	1.3
<i>Vepris stolzii</i>	3	2	3036	1
<i>Rapanea melanophloeos</i>	4	3	2926	1
<i>Syzygium sclerophyllum</i>	2	1	1704	0.6
<i>Psydrax parviflora</i> ssp. <i>rubrocostata</i>	3	2	1604	0.5
<i>Cassipourea malosana</i>	2	1	1455	0.5
<i>Catha edulis</i>	1	1	1452	0.5
<i>Olea capensis</i>	1	1	1320	0.4
<i>Casearia englerii</i>	3	2	1296	0.4
<i>Tabernaemontana pachysiphon</i>	2	2	1190	0.4
<i>Dombeya torrida</i> ssp. <i>erythroleuca</i>	2	2	660	0.2
<i>Macaranga kilimandscharica</i>	1	1	616	0.2
<i>Polyscias stuhlmannii</i>	1	1	471	0.2
<i>Cryptocarya liebertiana</i>	1	1	346	0.1

**Table 4.** Percentage basal area contributions of the species enumerated in the fixed area plots, arranged in order of cumulative basal area contribution. Species with a percentage contribution of less than 0.1 are regarded as having a negligible basal area ('neg')

Species	<i>Juniperus</i> forest			Shume-Magamba	
	Plot 1	Plot 2	1 + 2	2100 m	1800 m
<i>Catha edulis</i>	14.1	37.2	25.7	—	—
<i>Diospyros natalensis</i>	19.1	5.5	12.3	—	—
<i>Trichocladus ellipticus</i>	17.3	2.6	10.0	12.9	1.4
<i>Euclea divinorum</i>	—	16.3	8.2	—	—
<i>Warburgia ugandensis</i>	—	13.3	6.7	—	—
<i>Celtis africana</i>	11.3	neg.	5.7	—	—
<i>Cassipourea malosana</i>	10.8	—	5.4	0.9	—
<i>Rawsonia lucida</i>	8.7	1.7	5.2	—	—
<i>Juniperus procera</i>	—	9.7	4.9	—	—
<i>Ehertia cymosa</i>	9.4	—	4.7	—	—
<i>Maytenus</i> sp.	3.2	2.3	2.8	—	—
<i>Ekebergia capensis</i>	1.7	3.6	2.7	—	—
<i>Erythroxylum emarginatum</i>	1.2	2.3	1.8	—	—
<i>Scolopia theifolia</i>	3.1	—	1.6	—	—
<i>Trimeria grandifolia</i>	0.2	—	0.1	—	—
<i>Clerodendrum capitatum</i>	neg.	—	neg.	—	—
<i>Erythrocarpa fischeri</i>	neg.	—	neg.	—	—
<i>Ochna holstii</i>	neg.	—	neg.	—	—
<i>Psychotria alsophila</i>	neg.	—	neg.	—	—
<i>Solanum usambarense</i>	neg.	neg.	neg.	—	—
<i>Turraea floribunda</i>	neg.	—	neg.	—	—
<i>Polyscias stuhlmannii</i>	—	—	—	23.2	0.6
<i>Aphloia theiformis</i>	—	—	—	21.1	—
<i>Macaranga kilimandscharica</i>	—	—	—	12.6	—
<i>Maesa lanceolata</i>	—	—	—	8.2	—
<i>Psychotria cathycalyx</i>	—	—	—	5.0	0.26
<i>Casearia englerii</i>	—	—	—	2.5	—
<i>Ocotea usambarensis</i>	—	—	—	2.0	54.9
<i>Garcinia volkensii</i>	—	—	—	1.6	—
<i>Dracaena afromontana</i>	—	—	—	1.5	—
<i>Syzygium sclerophyllum</i>	—	—	—	1.5	—
<i>Memecylon deminutum</i>	—	—	—	1.1	—



Table 4. Continued

Species	<i>Juniperus</i> forest			Shume-Magamba	
	Plot 1	Plot 2	1 + 2	2100 m	1800 m
<i>Lasianthus kilimandscharicus</i> ssp. <i>laxinervis</i>	—	—	—	0.9	—
<i>Rapanea melanophloeos</i>	—	—	—	0.7	—
<i>L. kilimandscharicus</i> ssp. <i>kilimandscharicus</i>	—	—	—	0.7	2.3
<i>Maytenus acuminata</i>	—	—	—	0.33	—
<i>Xymalos monospora</i>	—	—	—	0.2	—
<i>Peddiea fischeri</i>	—	—	—	0.2	—
<i>Rytigynia uhligii</i>	—	—	—	0.1	—
<i>Chrysophyllum gorungosanum</i>	—	—	—	—	12.2
<i>Craibia brevicaudata</i>	—	—	—	—	6.8
<i>Strombosia scheffleri</i>	—	—	—	—	5.6
<i>Podocarpus</i>	—	—	—	—	4.9
Unknown	—	—	—	—	2.9
<i>Drypetes gerrardii</i>	—	—	—	—	1.9
<i>Dasylepis integra</i>	—	—	—	—	1.6
<i>Eugenia capensis</i>	—	—	—	—	1.0
<i>Pauridiantha paucinervis</i>	—	—	—	—	0.6
<i>Albizia gummifera</i>	—	—	—	—	0.1
<i>Ilex mitis</i>	—	—	—	—	0.1
<i>Asteraceae</i> sp.	—	—	—	—	neg.
<i>Psychotria</i> sp.	—	—	—	—	neg.
<i>Tabernaemontana pachysiphon</i>	—	—	—	—	neg.
<i>Vepris stolzii</i>	—	—	—	—	neg.
% BA in area assessed	0.31	0.47		0.41	1.19

of several normally common forest species, and the presence of several other species not usually associated with such habitats. The Usambara *Juniperus* forests are clearly unsuitable as a habitat for certain forest birds, their places being taken by some unexpected species. The distinct nature of the *Juniperus* forest suggests that it should be classified separately from other Usambara forest types, as was done by Pitt-Schenkel (1938) and Moreau (1935). Under the more recent system of vegetation classification devised for Africa as a whole (White 1983a), the forest is difficult to place. It lacks the species regarded as being characteristic of undifferentiated Afromontane forest, but is not sufficiently dominated by *Juniperus* to be regarded as single-dominant Afromontane *Juniperus procera* forest. A third possibility, dry transitional montane forest, contains some of the species found in the *Juniperus* forest.

**Table 5.** Avifauna of the two Shume-Magamba sites and the *Juniperus* forest (• indicates presence, – absence). Species common in the *Juniperus* forest are indicated in bold

Species	Shume-Magamba		<i>Juniperus</i>
	1800 m	2135 m	
<i>Accipiter tachiro</i>	•	—	•
<i>Buteo oreophilus</i>	•	•	•
<i>Hieraaetus ayresii</i>	•	•	—
<i>Stephanoaetus coronatus</i>	•	•	—
<i>Francolinus squamatus</i>	—	—	•
<i>Aplopelia larvata</i>	•	•	—
<i>Columbia arquatrix</i>	•	•	—
<i>Columba delegorguei</i>	•	•	—
<i>Turtur tympanistria</i>	•	•	—
<i>Tauraco hartlaubi</i>	•	•	•
<i>Cercococcyx montanus</i>	•	—	—
<i>Chrysococcyx cupreus</i>	•	•	—
<i>Chrysococcyx klaas</i>	•	—	—
<i>Ciccaba woodfordii</i>	•	•	—
<i>Apaloderma vittatum</i>	•	•	—
<i>Phoeniculus purpureus</i>	•	•	—
<i>Merops oreobates</i>	•	•	•
<i>Tockus alboterminatus</i>	•	•	•
<i>Buccanodon olivaceum</i>	•	—	—
<b><i>Pogoniulus leucomystax</i></b>	•	•	•
<i>Indicator variegatus</i>	•	—	—
<i>Dendropicus griseocephalus</i>	•	•	•
<i>Dicrurus adsimilis</i>	—	—	•
<b><i>Pseudoalcippe abyssinica</i></b>	•	•	•
<i>Coracina caesia</i>	•	—	—
<i>Andropadus masukuensis</i>	•	•	•
<i>Andropadus milanjensis</i>	•	•	•
<b><i>Andropadus nigriceps</i></b>	•	•	•
<i>Phyllastrephus debilis</i>	•	•	—
<i>Phyllastrephus cabanisi</i>	•	•	•
<i>Alethe fuelleborni</i>	•	•	•
<b><i>Cossypha caffra</i></b>	—	—	•
<i>Sheppardia montana</i>	•	•	—
<i>Modulatrix stictigula</i>	•	•	•
<b><i>Pogonocichla stellata</i></b>	•	•	•

Table 5. Continued

Species	Shume-Magamba		<i>Juniperus</i>
	1800 m	2135 m	
<i>Turdus olivaceus</i>	•	•	•
<i>Zoothera gurneyi</i>	•	—	—
<i>Apalis melanocephala</i>	•	•	•
<i>Apalis thoracica</i>	•	•	•
<i>Bradypterus lopezi</i>	•	•	•
<i>Bradypterus cinnamomeus</i>	—	—	•
<i>Orthotomus metopias</i>	•	•	•
<i>Phylloscopus ruficapilla</i>	•	•	•
<i>Muscicapa adusta</i>	•	•	•
<i>Batis capensis</i>	•	•	•
<i>Terpsiphone viridis</i>	•	•	—
<i>Trochocercus albonotatus</i>	•	•	•
<i>Dryoscopus cubla</i>	•	•	•
<i>Laniarius fuelleborni</i>	•	•	•
<i>Malaconotus nigrifrons</i>	•	•	•
<i>Prionops retzii</i>	—	—	•
<i>Cinnyricinclus sharpii</i>	•	—	—
<i>Onychognathus walleri</i>	•	•	—
<i>Poeoptera kenricki</i>	•	—	—
<i>Nectarinia mediocris</i>	•	•	•
<i>Nectarinia olivacea</i>	•	•	—
<i>Zosterops senegalensis</i>	•	•	•
<i>Ploceus nicolli</i>	•	•	—
<i>Cryptospiza reichenovii</i>	•	•	•
<i>Linurgus olivaceus</i>	•	•	—
Totals	55	46	35

The unique nature of the forest is further underlined by the occurrence of some unusual and interesting tree species. *Calodendrum eickii* is only known from this locality and is one of two species of *Calodendrum*, the other being *C. capense* which is widespread in upland dry evergreen forests throughout eastern and southern Africa, and from which it differs by having much larger fruits with longer spines and smaller flowers (Kokwaro 1982). The monotypic *Platypterocarpus tanganyikensis* is reported as occurring in the Shume *Juniperus* / *Podocarpus* / *Ficalhoa* forest, but was not found during the field work. *Ptaeroxylon obliquum*, a monotypic genus with a scattered distribution through southern Africa, is at its northern limit of distribution



here (White & Styles 1966). The only other genus in the Ptaeroxylaceae is *Cedrelopsis* from Madagascar (Pennington & Styles 1975). The *Diospyros natalensis* found at Shume is a distinct small-leaved variant with ascending branches, but is currently not regarded as being sufficiently distinct for formal taxonomic rank (White 1983b, 1988). No particularly rare or unusual bird species were found in the forests, but as a community, it is a unique assemblage. For this reason alone the small remaining area is worthy of careful conservation and management measures to assure its long-term survival.

The *Juniperus* forest is utilised by local people for a variety of products. *Juniperus procera* provides bark for roofing, and the split wood is used for fence construction. *Catha edulis* leaves are plucked for *khat*, a stimulant (Verdcourt & Trump 1969) which is gathered and sold outside the area. It is also a preferred firewood and the tree coppices readily. *Warburgia ugandensis* bark is regarded as a powerful medicine for chest complaints. *Olea europea* ssp. *africana* leaves are used to clean *pombe* (local beer) pots and to flavour the *pombe* itself. *Euclea divinorum* roots are used to help back ache, and the underbark is used to colour teeth yellow. *Trimeria grandifolia* roots are mixed with those of *Croton dictyophlebodes* and used against fatigue. Cattle and goats are also grazed in the forest, as grazing in the surrounding area has deteriorated due to soil erosion.

The *Juniperus* forest is also of potential economic importance as a provenance of timber species. The forests of the ancient crystalline mountains of south-east Kenya and eastern Tanzania (Eastern Arc mountains, Lovett 1988) have been isolated from other forest areas for a considerable period of time. Consequently species occurring in them may represent unique genotypes. Three tree species of the *Juniperus* forest are valued as timber. *Juniperus procera* was formerly used extensively for the production of pencils and window slats. *Ptaeroxylon obliquum* is a valued timber in southern Africa, and *Warburgia ugandensis* is also used (Coates-Palgrave 1977, Dale & Greenway 1961).

The *Juniperus* forest is thus of conservation importance for a number of reasons. It is the last remnant of a more widespread forest type in the West Usambaras which is markedly different from the other forest types. It contains a number of species of restricted or interesting distribution. It is heavily utilized by the local people as a source of forest products, and it represents a genetic resource for a number of species of economic interest.

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